The idea of the library in the twenty-first century*

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The fundamental idea of the library must change. The nineteenth-century idea of the library as the embalming of dead genius and the twentieth-century idea of the library as the repository for second-hand knowledge must give way to the idea of the library as the owner and the librarian as the manager of first-hand knowledge. In the coming era of knowledge capitalism, those individuals and organizations will flourish who are able to apply knowledge to create knowledge and to organize it to produce knowledge. The roles of present-day librarians and libraries will begin to differentiate sharply over the next decade. Some must seize the opportunity to participate in the transformation of libraries into online knowledge servers.

In 1967, the late Gertrude Annan, librarian of the New York Academy of Medicine, inaugurated the Janet Doe Lectures on the history or philosophy of medical librarianship with an elegant and lucid history of the previous thirty years of the Medical Library Association. Every Doe lecturer since has disclaimed professional qualifications for writing history or philosophy. Yet, each has struggled to follow in Annan's footsteps and to live up to the honor of the lectureship. All have written about what they hold nearest and dearest to their professional hearts, seeking to inform, to provide insight, to inspire, and even to entertain.

I lack not only the training and knowledge but the temperament for writing either history or philosophy, although I think I can write an opinion. In fact, as a daughter of an illiterate immigrant mother for whom the past was mainly an unhappy encumbrance and was left behind without regret, my bent is to do what Marshall McLuhan advised: to look through the windshield instead of the rear-view mirror.

I have decided to follow the example set by David Kronick in his 1980 Doe Lecture, "The Librarian's Life, Scholarship and Librarianship," which is similar in structure to the Charles Homer Hoskins Lectures given annually at the American Council of Learned Societies. Each year, a distinguished scholar is invited

to give a lecture titled "A Life of Learning" in which she or he (mostly he, of course) describes how he came to his vocation and what he found in its practice. I have always admired these lectures and look forward to reading them, for they invariably treat their subject with wit and grace, they are entertaining models of academic discourse, and they offer insight into the ways of the scholar that I like to think is useful. These accounts rarely make any special reference to libraries. Libraries seem to scholars like the air they breathe—hardly worthy of remark unless in bad odor.

Our work is not trivial; neither is it without worth or dignity, but it is not terribly important in the life of the mind. The reason for this is plain. It lies partially in the fact that our work deals only indirectly with knowledge. The opening words of Aristotle's *Metaphysics* are "All men by nature desire to know." Our culture places high value on discovery, on first-hand knowledge. As A. N. Whitehead observed, "First-hand knowledge is the ultimate basis of intellectual life. To a large extent book learning conveys second-hand information, and as such can never rise to the importance of immediate practice" [1]. And yet, one must have knowledge in order to discover new knowledge. The source for that knowledge now is a library. The life of the mind may owe much to the existence of libraries, but it has little to do with the idea of the library, and rarely to do with the making of libraries. I believe that must change over the next decade.

Like most previous Doe lecturers, I found selecting

the topic the first and most difficult part of the assignment. Virginia Holtz said the selection process for her had "overtones of an exorcism." My trouble is more like that of another librarian's, Philip Larkin, whose fame derives from his poetry rather than his professional life. In one of his letters he said, "My trouble is that I have only two ideas or so to rub together, and when they are rubbed together remorselessly for 150 pp. the reader gets restive" [2]. Let me hasten to assure you that this Doe lecture is not that long. I also feel about my work as Ursula LeGuin does hers. She describes it as "pushing at my own limitations and at the limits of science fiction. That is what the practice of an art is, you keep looking for the outside edge" [3]. I know that many of my colleagues feel that some of the ideas I have urged on them are closer to science fiction than the art of librarianship. She also said that she doesn't know how to answer the question frequently asked by fans: "Where do your ideas come from?" They come from everywhere and nowhere. So she says she tells people they come from Schenectady. But of course they come from living, from doing work.

THE IDEA OF CHANGE

In the final reckoning, I believe I may, in my career, have had two ideas. I seem to have been rubbing together my two sticks for some time, hoping to light fires here and there. These ideas have emerged from remorselessly pushing the limits of the idea of the library and of our professional capabilities as librarians. One idea is that librarians and libraries must be agents of change. This idea most of you here are familiar with as Integrated Advanced Information Management Systems (IAIMS). The other idea is that the fundamental idea of the library must change, that our business should be the ownership and management of first-hand knowledge rather than the mere storage and dissemination of second-hand knowledge. According to John Henry Newman, the nineteenth-century English philosopher and educator, "A great idea changes in order to remain the same. In a higher world it is otherwise, but here below to live is to change, and to be is to have changed often" [4]. Newman spoke of change as a philosopher. Perhaps we should listen, as well, to a scientist. H. G. Wells put it this way:

Every species of living thing is always adapting itself more and more closely to its conditions. And conditions are always changing. There is no finality in adaptation. There is a continuing urgency towards fresh change [5].

It is this second idea—that the ownership and management of knowledge is the library's business—that I would like you to think about today.

THE NINETEENTH-CENTURY IDEA OF THE LIBRARY

Since choosing this career, by happy accident, the idea of what a library is and must be has been a part of every waking day. From the beginning, this has been, for me, the best of professions. It is the best of professions because I believe that the library is a "great idea" in the sense used by Newman. The library is fundamental and pivotal to the continuation and development of civilization. To contribute to and extend this development is a worthy use of one's life.

I started my professional career with an internship at the New York Public Library in the pre–information age, in 1958, before many of you here today were born. It was a time before photocopy machines, IBM mainframes, MEDLARS, even electric typewriters. That was not the first library job I held. I started working in my high school library because I needed money and wanted access to books, especially to the encyclopedia, because I thought that was where real knowledge was. In those days you needed permission from a teacher to get into the library, which was very small; although, occasionally, unruly students were banished from study hall into the library as a kind of solitary confinement. I found it easier to go to work in the library than to explain every day why I wanted to be there. When I arrived at the University of Washington, I found a closed-stack library, to which only employees, graduate students, and faculty had access. So I got a job in the library. It is my misfortune, I suppose, that I didn't want access to money, else I would have gotten a job in a bank. I wanted access to the stacks in order to be free to come and go in the library as I wished and choose from the entire wealth that was there, not because I really needed access in any purposive way. This is possibly one of the characteristics of late-twentieth-century humans and which knowledge servers must take into account: the propensity to want access to it all, even if there is need and ability to use only a fraction of that desired.

There I discovered the key limitation of my life and idea of the library. The access points to knowledge—the libraries, the catalogs, the indexes, the textbooks, the monographs, the journal articles, the encyclopedias—are only primitive approximations of access to knowledge. It was then that I discovered the limits of libraries as a technology. There is no way to get an orderly display of knowledge in any specific domain. There are only little peepholes to some portion of the elephant known as a discipline. We all know this library reality, especially scholars and, more especially, those students who gave up on libraries early along the education pathway. The barriers only begin with the library as a place. The barriers ascend

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Figure 1
Paul Erhlich

Figure 2
Reference room, National Library of Medicine, Seventh and Independence Avenues, S.W., Washington, D.C.
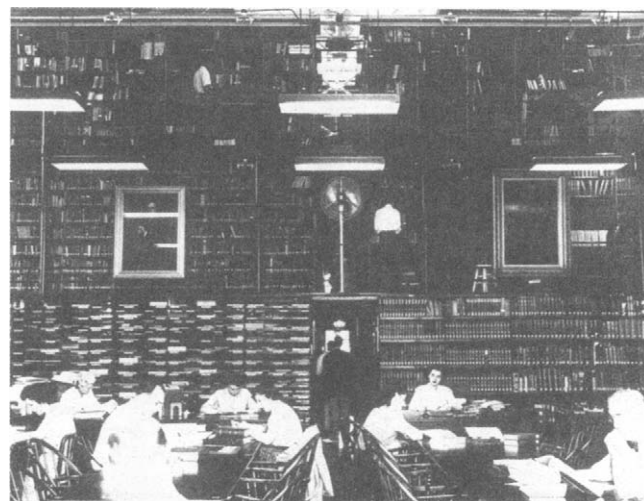

through each of the levels imposed by the forms in which knowledge is described or encapsulated.

I did not go to library school to address these problems. In fact, I don't think anyone thought of these limitations as anything but the natural condition of things. Like most of us, I was looking for a way to make a living, not to change an institution. The prevailing idea of the scholar, the scientist, the author, the editor, the librarian, even in 1958, is epitomized in the famous picture of Paul Erhlich dwarfed and hemmed in by the stacks and piles of papers that line the walls and cover the floor and chairs of his office (Figure 1). Even today, a wall of books and stacks of paper are used as background to convey the idea of authority, intellectual life, possession of knowledge, scientific merit. Even today, the offices of some librarians, administrators, and scholars look like this, and we know what they think of the library of the future.

The reference room of the National Library of Medicine when it was the red brick building at the corner of Seventh and Independence, S.W., Washington, D.C., was more orderly than Erhlich's office, but it was clearly the same idea (Figure 2). I worked there in 1959, occasionally passing Eugene Garfield in the hallways. It was there that Garfield conceived of the *Science Citation Index*, that noble effort to provide context and relationships to isolated bits of knowledge and information. It was there, certainly, that parts of the so-called Matheson report began to germinate, for I was there when Frank Rogers began to bring MEDLARS into being and the modernization of bibliographies and indexes began. Even from my insig-
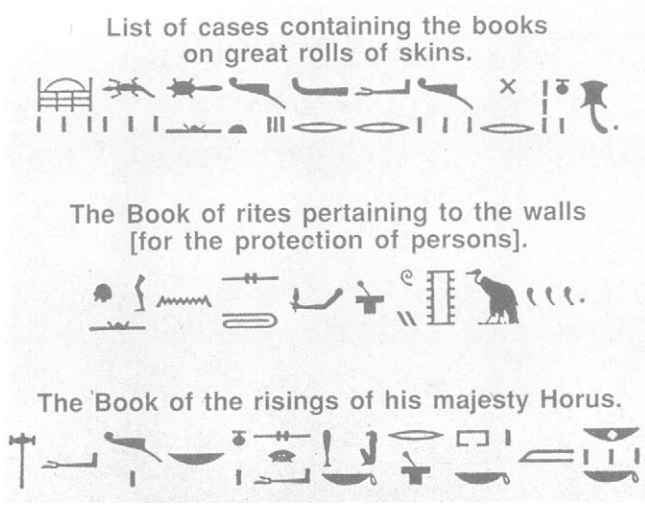
nificant position as a searcher in the Acquisitions and Order Division, the lessons were plain. The idea that a library had the power and capability—even the authority and responsibility—to create a product possessing universal value has never left me. Nor did I ever forget that Rogers had brought together a multidisciplinary team of librarians, computer specialists, indexers, and content expert advisors to get the job done. Neither can I ever forget the grinding tedium, the mind-numbing and soul-shriveling character of most of the work done in libraries that makes possible the life of the mind and the discovery of new knowledge. I am glad that I haven't had to labor on the card catalog or in the stacks for some decades, just as I was able to leave behind laboring in the fields and on assembly lines. But I am not glad at all that there are still people who must do this work.

Because chance took me to the Midwest, I did not have an opportunity to participate in the development of MEDLARS. But I did have the good fortune to be in the same city as Estelle Brodman, one of our great medical librarians. From her, I learned some of the most valuable lessons of my professional life, the most important being that research can free you from the tyranny of the routine, from the yoke of received opinion, and the swamp of wishful thinking.

Research is the essential first condition to understanding, and from understanding change can flow. One aim of research is to find the correct solution to a problem. But the problem, the question, must first be clearly formulated and articulated. Behind any sig-

Figure 3
Catalog entries, wall of the House of Papyrus, Edfu, Egypt

List of cases containing the books
on great rolls of skins.

The Book of rites pertaining to the walls
[for the protection of persons].

The Book of the risings of his majesty Horus.

nificant research there must be a fundamental and important question to be answered.

I have never been convinced that there is significant research to be done in our discipline of library science, which is in its character a kind of management science. If we continue to conceive our mission to be managing libraries and the materials collected in libraries and focus our research in this arena, we will shortly reach a dead end. Data from research can lead to improvement in services and the modernization of libraries, but this application of knowledge to organizing efficient work, useful in an era of industrial capitalism, will, as Peter Drucker points out, be a dead end in the next era of knowledge capitalism [6]. Knowledge in the next era is a capital resource. The talent and ability to apply knowledge to create knowledge and to organize it for useful purposes will be fundamental to the survival and growth of organizations as well as individuals.

THE TWENTIETH-CENTURY IDEA OF THE LIBRARY

These days, molecular biologists, geneticists, and biophysicists are decoding the encryption of life and the rules governing the development and functioning of life forms. What are librarians, information scientists, and publishers doing? We have custody of the encryption of civilization and culture. We are in the process of digitizing these instantiations of knowledge, known as texts, with the aim of creating the virtual library. The idea of the virtual library is fixed on present models of knowledge discovery and pub-

lication and, as such, is little more than the latest version of the emperor's new clothes. If we put ourselves, scholars, and scientists in front of graphical user interface (GUI) screens and present an endless hypertext chain of information bytes, we may have done away with libraries and stacks, but we will not have any better representation of knowledge. We will have ignored the primary advantage of electronic publication, which is the ability to "concentrate resources for discovering and utilizing information" [7] in favor of more rapid dissemination of text.

Some have characterized our present era as the incunable stage of digital knowledge management. We may be at an even earlier stage in terms of knowledge representation, something more like Sumerian cuneiform. When I found these images, I thought I was looking at ASCII characters (Figure 3). Actually, these are catalog entries carved on the wall of the library at Edfu, Egypt, known as the House of Papyrus. The books the wall carvings describe were written on papyrus and animal hides and disintegrated centuries ago [8]. Certainly efforts were made to transcribe valuable texts to other more permanent forms. Even clay tablets, which appear so permanent, were recopied as marks blurred from use, and chips, cracks, and breakage occurred. Over these next decades, the most useful information and knowledge on paper will be digitized and will thus survive and evolve. Once we possess a critical mass of both in digital form, perhaps some of us can begin significant research in our field, getting to fundamental questions having to do with the application of knowledge to produce knowledge, rather than to questions having to do with the effective delivery, organization, or management of information. Carlos Fuentes has said that "The greatest crisis facing modern civilization is going to be how to transform information into structured knowledge" [9].

The rest of the mass of information remaining on paper not digitized will become merely interesting artifacts, occasionally yielding some knowledge. These are the volumes in our libraries that have fallen through every modernizing sieve of the past four decades: first, those that were never reclassified in the cataloging era; then, those that were never barcoded in the automation era because no one wanted to check them out; then, those that were moved to remote storage in the no-growth era because of lack of use or the conviction that the information they contained was obsolete but that have been retained, "just in case." A few libraries need to become just-in-case libraries for the traditional resources so that the just-in-time libraries can operate. The time is coming, however, when libraries must choose between these roles: owning traditional resources and making them available; developing and owning new digital knowledge resources and making them accessible; or

being an organization that knows where knowledge is and teaches how to mine it (which is what academic departments do).

Some might interpret what I have just said as advocating the destruction of the printed book and journal and the elimination of libraries. Not at all. Alvin Kernan may be right when he says that literature will disappear in the electronic age because it is a product of a print culture and industrial capitalism and because a new kind of discourse will emerge [10]. I do not believe either books or literature will disappear. But I think many libraries will wither and disappear because they are too small to be cost-effective or to find a role as a useful player in the larger restructuring taking place in the scholarly communication system.

There are many who claim that books will not disappear and that for that reason, neither will libraries. When I hear that argument, a quip of Groucho Marx springs to mind: "Marriage is the chief cause of divorce." Printed matter is not the chief cause of libraries. Indeed, it might be more true that libraries are the chief cause of books and journals. No, it is the demand for information and the need for specific knowledge that causes libraries. The books that will not disappear are likely to be those that are meant to provide entertainment. It may well be that public libraries will continue to exist, but whether scholarly, scientific, research, or professional libraries will continue into the future, functioning as they do today, albeit digitally, is altogether another matter.

Eighteen months ago, the book might have been the cheapest, most convenient, and most efficient technology for delivering information. But with the widespread distribution of Mosaic software, the establishment of the World Wide Web, and the expansion of Internet, the equation has changed irrevocably. Mosaic has touched off an amazing burst of new technology development and excited corporate investment on a scale that I've never before seen. More has happened to advance the use of information technologies in the academic workplace over the last ten months than in the past ten years. The recognition by this administration that information technology is a primary means to economic recovery and growth for this country has ignited an explosive surge in new thinking and development in the information industry. More than one million copies of Mosaic are in circulation in the public domain, and it is about to be commercialized [11]. By enabling documents to include text, graphics, video clips, and sound and by enabling the user to move from within a document to another linked source on machines elsewhere in the world, the Mosaic software breaches the last barriers to a fundamental change in the information transfer system. While far from perfect in its present stage, which is more like a hyped-up Gopher, it has transformational potentials that Gopher does not possess. Using Mosaic software, H. G. Wells' idea of the World Brain is realistic and achievable over the next decade.

THE TWENTY-FIRST-CENTURY IDEA OF THE LIBRARY

I reluctantly conclude that the "library of the future" as we have come to think of it is already a thing of the past. Most libraries of today cannot be the libraries of the future. Some, perhaps, will continue as libraries, as useful coherent assemblages of knowledge in text forms. Such great special collections in the arts and sciences, as the Lilly Library at Indiana University, the Morgan Library in New York, the Beinecke Library at Yale, the Huntington Library in Los Angeles, the Folger Shakespeare Library, the Humanities Research Center in Texas, will continue to be libraries in the future because they are unique and are true to the idea of the library that grew and emerged from the great universities of Western civilization. They are unique because they have systematically collected primary source materials, manuscripts, and historical documents, as well as the scholarship derived from those materials. These collecting goals are linked to the principles set forth by John Henry Newman in 1852, which define the university as the place where universal knowledge is taught and which have as their aim "the support of teaching as the endowment of living [genius] and the establishment of a library as the embalming of dead genius" [12]. Pelikan says that even in 1852 the idea of teaching universal knowledge was—and he used the word—a "fatuous" goal, given the quantity of information available. But he goes on to say that "universal knowledge can and must remain an ideal for the university of the future," but only if there is a rational approach "involving the allocation of fields of knowledge, periods of history, laboratory instrumentation, and library resources—ultimately, perhaps, even of faculty. Otherwise, the world of scholarship could wake up some cold morning to find that no one is collecting materials or doing research or teaching courses in ancient Egyptian mathematics or the dialects of Galicia" [13]. Now, most rational people know how infrequently rational approaches prevail. Still, it is surely irrational for society to carry into the electronic environment the idea of the library of today. We must find a way to allocate the fields of knowledge among digital knowledge servers.

There are indications that university administrators are searching for ways and means to find an alternative to the one-library, one-university model. This hope is not new, of course. Thirty years ago, the architects of the Regional Medical Library Network hoped that it would evolve in such a way as to elim-

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inate the need for small local libraries. A ubiquitous electronic environment makes this hope more than wishful thinking. Indeed, recently, "A dozen universities have announced plans to cooperate in creating a massive on-line library that would serve all of their campuses" [14]. The member universities are an imposing group: the universities of Chicago, Illinois, Iowa, Michigan, Minnesota, and Wisconsin, as well as Indiana, Michigan State, Northwestern, Ohio State, Pennsylvania State, and Purdue universities.

Many of us believe that faculty will resist and oppose the idea of the digital library (that is, one library serving many institutions). Many faculty may do so and would advise librarians as Gordon Ray did in 1966; that is, to "remain librarians, not what Samuel Butler, in his vision of a mechanized future in Erewhon, calls 'machine tickling aphids'" [15]. Today, there is evidence that more and more faculty in the humanities, as well as the sciences, would be very content to dip from electronic wells, and it does not matter a great deal to them who owns or manages these electronic wells, so long as they are freely and cheaply accessible.

For example, in a closely reasoned article, titled "Tragic Loss or Good Riddance? The Impending Demise of Traditional Scholarly Journals," Andrew Odlyzko of AT&T Bell Laboratories presents the case for mathematics [16]. He is definitely on the "good riddance" side. Odlyzko estimates that the annual production of mathematical publications in its current form, if digitized, will require no more than seven gigabytes' storage. The entire body of mathematical literature in bit-mapped form would require only 1,000 gigabytes of storage. If this sounds very large now, it will not be for long. As he points out by way of comparison, Wal-Mart has active files this large in daily use. In a world where any mathematical department can either access or store the world's mathematical literature, the warehousing role of libraries vanishes. "Technology will solve the librarians' problem," Odlyzko observes, "but will also eliminate most of their jobs." He goes on to say encouragingly, "There will always be positions for experts in information, to help in navigating the oceans of data on the Net, but their roles will cover only the most sophisticated skills that librarians possess." Influential and sympathetic academic cybernautic faculty like James O'Donnell suggest that we are entering ". . . a world in which the library will cease to be a warehouse and become instead a software system. . . ." In that world, he says, "the value of the institution will lie in the sophistication, versatility, and power of its indexing and searching capacities" [17].

But, surely, you and I must question whether each institution will need its own software system. Isn't this the digital version of the old mind-set? It is not that each *institution* will need to develop its own soft-

ware system but that each *discipline* will need a software system best suited to its knowledge representation and problem-solving needs. The one-format-fits-all, which is the book model, is surely inadequate and obsolete. This idea is most clearly embodied in the elephant known as the Human Genome Project. In 1989, the William H. Welch Medical Library of The Johns Hopkins University became directly involved with one of the appendages of the elephant, the Genome Data Base (GDB). When the human genome is mapped down to the final nucleic acid sequence, the result will be what some have called "The Book of Life" of human life. Each datum in the database is tagged with date and source, which may be an individual, a laboratory, or a published article. The data are placed in relative relation to one another. Over time, these interlocking data will form a single continuum that is the human genome. This means that a linkage can exist between data, between information (i.e., relationships between data), and between knowledge (i.e., the meaning of the data). These books-of-life are being written for every life form on this planet, whether flora or fauna, and each book is likely to have somewhat different constructs. The biological intersections of species will result, eventually, in an "Encyclopedia of Life." The genome databases (or books-of-life) for numerous species are now being brought together in a federation, which could be construed to be a new form of library, from which books-of-life the encyclopedia of life could be derived. The derivation of such an encyclopedia will require the creation of new tools for discovery, analysis, and synthesis. The research and development of these tools is going on now, as a collaboration of the scientists using the GDB and the scientists managing the database. Four years ago, when the GDB was conceptualized, it was to be the electronic representation of the human gene map and, as such, was an archive of known, verified information. It was essentially Whitehead's second-hand information and, as such, of only moderate interest. Today, the GDB is seen as a living, evolving knowledge base, the centrality of which is no longer in doubt. This is one example of the idea of knowledge management.

The idea of the library is no longer the mausoleum of dead genius as it had been in the nineteenth century. In the twenty-first century, the idea of the library will be a knowledge server, an encyclopedic source of knowledge, the encryption of what is known of civilization, culture, and the organization of the universe. In the twenty-first century, knowledge sources cannot be parochial or provincial or even nationalistic, created in the image of the institutions they serve: they must be neither privately owned nor commercially oriented. These knowledge sources, some of which will still be called libraries, must be dedicated to information and to knowledge; their

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storage, acquisition, dissemination; and their management over all time. These knowledge sources must be specialized in both function and scope, and they must be the intellectual responsibility of those responsible for creating knowledge.

Seventy-five years ago, H. G. Wells wrote,

With the invention of writing . . . An increasing number of human beings began to share a common written knowledge and a common sense of a past and a future . . . It is a thin streak of intellectual growth we trace in history . . . it is like a mere line of light coming through the chink of an opening door into a darkend room; but slowly it widens, it grows. At last came a time in the history of Europe when the door, at the push of the printer, began to open more rapidly. Knowledge flared up, and as it flared it ceased to be the privilege of a favoured minority. For us now, that door swings wider, and the light behind grows brighter . . . The door is not half open; the light is but a light new lit. Our world to-day is only in the beginning of knowledge [18].

That was in 1920. We are at another time in history, when the door, at the push of the computer, begins to open further and possibly even more rapidly. Our world today, however, is still only at the beginning of knowledge.

In my lifetime I have seen libraries modernized. In the lifetime of most of you here today, libraries will be transformed. Some of you have the opportunity to participate in making your libraries knowledge servers. You will make the history that future Janet Doe lecturers will reflect on. The next decade will provide some of the most exciting, exhilarating, and uncomfortable years of our profession. Such an opportunity for the profession and for libraries to revitalize and reinvent themselves, to re-set their boundaries and responsibilities, may never come again. Seize the day.

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